



Task Group 1/5**DRAFT PROPOSED TEXT FOR THE DRAFT CPM REPORT TO WRC-2000****AGENDA ITEM 1.2**

In considering Recommendation No. 66(Rev. WRC-97), “Studies of the Maximum Permitted Levels of Unwanted Emissions,” and in particular its *recommends* 1., 2. and 6, ITU-R [Task Group 1/5 has agreed]¹ the attached Annex as its contribution to the Conference Preparatory Meeting (CPM) for WRC-2000. The attachment addresses (i) space services spurious emission limits and how they are applied, (ii) radiodetermination (radar) spurious emission limits that may be interpreted in different ways in Appendix S3, (iii) the limiting case of a very narrowband or unmodulated signal in a wideband amplifier, (iv) the special case of application of spurious emission limits in adjacent transponders within the same transmitting system, (v) amateur earth stations operating below 30 MHz, and (vi) an exemption from spurious emission limits for deep space satellites.

Studies within Task Group 1/5 emphasize the need for further studies, both on a general and on a band-by-band basis, of spurious emissions limits so as to better protect passive services including radio astronomy, and safety services.

It is noted that some additional CPM texts are likely to be proposed during the next TG 1/5 meeting in January 1999, following the conclusions of on-going studies.

**DRAFT PRELIMINARY PROPOSED TEXT FOR THE DRAFT CPM REPORT TO
WRC-2000****1 WRC-2000 Agenda Item 1.2 - (relative to Recommendation 66(Rev.WRC-97),
“Studies of the Maximum Permitted Levels of Unwanted Emissions)**

1.2 to finalize remaining issues in the review of Appendix S3 to the Radio Regulations with respect to spurious emissions for space services, taking into account Recommendation 66(Rev.WRC-97) and the decisions of WRC-97 on adoption of new values, due to take effect at a future time, of

¹ This draft CPM contribution is considered to be in square brackets in its entirety. It will be discussed at the January 1999 meeting of Task Group 1/5 with the intention of finalizing the text for submission to the editing group preparing the draft CPM Report for presentation to the Conference Preparatory Meeting.

spurious emissions for space services. Although not specifically defined in Article S1 of the Radio Regulations, the term “space services” is taken to be any service which uses “*Space Radiocommunication*” as is defined in Article S1.

2 Summary of Technical Studies

2.1 Appendix S3 of the ITU Radio Regulations contains tables of maximum permitted spurious emission power levels. Table I contains the current values, while Table II applies to transmitters installed after 1 January 2003 and to all transmitters after 1 January 2012. Note 14 of Table II identifies the spurious emissions limits for space services as “design objectives” until after WRC-2000.

2.2 In response to liaison statements, the ITU-R Working Parties 4A (FSS applications) and 8D (MSS applications) have taken the position that they saw no further need for the “design objectives” qualification for space services limits and that, at this time they believe that no changes to the attenuation values or the reference bandwidth for space services are applicable.

2.3 Appendix S3 also includes a paragraph addressing measurement methods for radar systems. The inclusion of this paragraph under Section I, however, implies that the current spurious emission limits also apply to radar systems. In a liaison statement to Task Group 1/5, Working Party 8B has recommended changes to Appendix S3 that would indicate that spurious emission limits apply to radar systems only under Section II. Studies within Task Group 1/5 have reached the same conclusion.

2.4 Working Party 8B requests modification of Section II of Appendix S3 to indicate that spurious emission levels for radar systems should be based on radiated emissions, and not measured at the transmission line. This would ensure that the measured spurious emission levels account for the inherent selectivity of certain radar antennas. Studies within Task Group 1/5 have reached the same conclusion.

2.5 Studies within Task Group 1/5 indicate an anomaly in Appendix S3 for amateur earth stations. Amateur earth stations use the same transmitting equipment as amateur stations, both below and above 30 MHz, and there is no reason for the same terrestrial-based equipment to be subject to different spurious emission requirements only at the time of transmitting to amateur space stations. Below 30 MHz, amateur stations and amateur earth stations, both operating in the amateur service, use $43 + 10 \log(\text{PEP})$, or 50 dB, whichever is less stringent in determining the applicable spurious limit. Above 30 MHz, Appendix S3 currently requires amateur earth stations to fall into the “All services” category of Table II, viz., up to 70 dBc suppression, which causes amateur earth stations to have more restrictive limits than other earth stations. Furthermore, longer-term studies within Study Group 8 should address the appropriate use of spurious emission spectral density limits (dBs) in this case as an alternative to dBc, as some amateur earth stations use SSB emissions. A new footnote in Table II applied against “Space services (earth stations)” would be appropriate for such case.

2.6 Studies within Task Group 1/5 have shown the difficulty with very narrowband or unmodulated space service signals, and with spurious emissions from one transponder that fall into a companion, second transponder within the same amplifying system. Separate self-explanatory Headnotes 11bis and 11ter to Appendix S3 have been proposed to cover these cases.

2.7 Studies within Task Group 1/5 have concluded that there is no reason for *Deep Space* spacecraft, as defined by the ITU Radio Regulations, to have any spurious emission limits. An exemption for these spacecraft is proposed.

3 Analyses of Results

3.1 Task Group 1/5 has addressed the issue of spurious emission limits for space services, with the intent of investigating the feasibility of providing additional protection for safety services and passive services such as radio astronomy, and the impact on all concerned services. In its studies, Task Group 1/5 considered modifications to both the “design objectives” levels and to the reference bandwidth. Based on conclusions from relevant space service working parties and other extensive contributions to the studies within the Task Group, it is recommended that WRC-2000 review Appendix S3 taking into account the considerations given in Section 5, below.

3.2 With respect to the radiodetermination issue, Task Group 1/5 concludes that WRC-97 did not intend to include radar systems under the spurious emission limits of Section I of Appendix S3. Radar systems had been exempted from the limits in Section I because the required measurement methods had not been determined. The measurement methods now provided in Recommendation ITU-R M.1177 pertain to the spurious emission limits in Section II, which apply to radar transmitters installed after 1 January 2003 and to all radar transmitters after 1 January 2012.

3.3 Task Group 1/5 also agrees that some radar antennas, such as slotted arrays and some distributed phased arrays, have inherent selectivity reducing the level of spurious emissions. For this reason, Appendix S3 should indicate that spurious emissions of radar systems should be based on the radiated field, not the power in the transmission line.

3.4 Task Group 1/5 considered the situation of amateur earth stations which use the same transmitting equipment for communication to both space and terrestrial stations but which currently fall into two spurious emission categories depending on which of these two ways the service is used. A relevant modification to the category of “Space services (earth stations)” in Table II of Appendix S3 is suggested.

3.5 Task Group 1/5 examined the use of *Deep Space* spacecraft which have emissions that are so weak that only unusual communications equipment, using massive antennas and very low noise cooled amplifiers, can detect even the fundamental signal yet alone any spurious emissions. A consequential suggestion is made to exempt such *Deep Space* spacecraft from requirements for spurious emission limits.

3.6 Task Group 1/5 concluded that very narrowband or unmodulated transmissions, where practical application of the term “necessary bandwidth” may be difficult to apply in determining the domain of spurious emissions, needs special treatment. Consideration of appropriate text on this point is suggested.

3.7 Task Group 1/5 addressed a satellite system where a spurious emission from one transponder may fall on a frequency used by another transponder in the same satellite, but where the second transponder has fundamental emissions well in excess of the spurious emission. This situation may deserve treatment by the WRC-2000.

4 Advantages and Disadvantages

Adoption of the spurious emission limits currently included in Appendix S3 for space stations of the space services will provide a general degree of protection for other systems, while not placing an unreasonable burden on the space services given the current state of technology and cost effectiveness of implementing systems. It is recognized that general limits alone are not sufficient to protect certain vulnerable services. Revising the language in Appendix S3 regarding radar systems will correct the implication that radars are subject to spurious emission limits under Section I, and rightly provide for measurement of radar spurious emissions in the radiated field, allowing for

consideration of the benefits of antenna selectivity. Special consideration is necessary for the previously unconsidered amateur earth stations, very narrowband or unmodulated signals, *Deep Space* space stations, and companion transponders operating within the same satellite.

5 Regulatory and Procedural Considerations

5.1 To indicate adoption of the space services spurious emission limits currently designated “design objectives,” delete Footnote 14 in Table II of Appendix S3 to the ITU Radio Regulations.

5.2 To correct a possible misunderstanding regarding the applicability of spurious emission limits for radar systems, add a new Headnote No. 6 above Section I to read as follows:

Radiodetermination (radar) systems are exempt from spurious emission limits until Section II of the revised Appendix S3 comes into effect, i.e., spurious emission limits apply for radar transmitters installed after 1 January 2003 and for all transmitters after 1 January 2012.

5.3 The existing Headnote No. 6 immediately under Section I should be deleted. To indicate that spurious emission levels for radar systems should be determined from radiated emissions, add a new footnote to the “Radiodetermination” service category in Table II of Section II to read as follows:

Radiodetermination (radar) system spurious emission dB attenuation shall be determined for radiated emission levels, not at the antenna transmission line. The measurement methods for determining the radiated spurious emission levels from the radar systems should be guided by Recommendation ITU-R M.1177.

5.4 To permit the use of these measurement methods indicated in 5.3 above, modify existing Headnote No. 8 of Section II, adding the words “or appropriate” after the phrase “when it is not possible.”

5.5 To adequately recognize the case of very narrowband and unmodulated signals, add a new Headnote 11bis to Appendix S3 to read as follows:

As an emitted signal becomes more and more narrow (to the limiting case of an unmodulated carrier with theoretical necessary bandwidth of zero), the application of the term “necessary bandwidth” as used in determining the region where spurious emission limits apply, becomes more and more difficult. In the limit, +/-250% of necessary bandwidth (generally recognized as establishing the region beyond which spurious emissions are defined), approaches zero. Beacon and other unmodulated signals, such as those used in uplink and downlink circuits in control and tracking of satellites, are examples of a case where it is difficult to practically apply the term “necessary bandwidth” in determining where out-of-band emissions end, and spurious emissions begin. Pending further studies and definitive action by a future World Radiocommunication Conference, in calculating the region where spurious emission limits apply for transmitters using amplifiers to pass essentially an unmodulated signal (or a signal with very small bandwidth), the amplifier bandwidth is taken to be the necessary bandwidth (in calculating the regions where spurious emissions apply).

5.6 To avoid unnecessary design and operational requirements for adjacent transponders in the same transmitting system, add a new Headnote 11ter to Appendix S3 as follows:

For satellites employing more than one transponder, and when considering the limits for spurious emission as indicated by Headnote 11 to Appendix S3, spurious emission from one transponder may fall on a frequency used by a companion, second transponder and are found there at a level of spurious emission which is well exceeded by fundamental emissions of the

second transponder. This situation is always under control of a satellite designer or system operator who must ensure such spurious emissions cause no intrasystem interference. Limits of Appendix S3 should not apply to those spurious emissions on a satellite which fall within the transponder frequency bands where there are transmissions from the same satellite.

5.7 To avoid amateur earth stations having to comply with spurious emission limits different from amateur stations, add a new footnote in Table II, to the “Space services (earth stations)” category, as follows:

Amateur earth stations operating below 30 MHz are in the service category “Amateur services operating below 30 MHz (including with SSB).”

5.8 To cater for *Deep Space* space stations, defined in the Radio Regulations as those at distances from the Earth equal to, or greater than 2×10^6 km, and which have essentially undetectable spurious emissions in every case, add a new footnote in Table II, to the “Space services (space stations)” category, as follows:

Deep Space space station systems, as defined by Article S1 as beyond 2×10^6 km distance from the Earth, are exempt from spurious emission limits.
